

**DEER CENSUS AT HOMESTEAD NATIONAL MONUMENT OF AMERICA USING DRIVE METHOD**

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## Executive Summary

Natural resource managers, staff and volunteers at Homestead National Monument (NM) of America, a 195 acres (.305 mile<sup>2</sup>) NPS unit in southeastern Nebraska conducted 11 deer censuses between May 2003 and February 2004 to establish baseline deer population numbers. Average number of deer observed across censuses was 19.6 individuals per census for a deer density of 76 individuals/mile<sup>2</sup>. Deer numbers ranged from 36 individuals/mile<sup>2</sup> in the late summer to 140 individuals/mile<sup>2</sup> in the late fall. Outcomes of the current and future censuses are an increased understanding of deer numbers within the Monument and a great opportunity for volunteers to assist in natural resource monitoring and management.

## Acknowledgments

The author and Homestead National Monument of America would like to thank the Heartland Network Inventory and Monitoring program for funding this project, Mike Williams and Dan Licht, Meg Plona, and David Peitz for technical guidance and reviewing the report, and the Volunteer Senior Ranger Corp for providing the people to carry out the census. Special thanks to Jerry Davison for organizing the volunteers and being our official photographer.

## Introduction

Homestead NM of America is a monument to the Homestead Act of 1862. In March 1936, Congress established the Homestead National Monument of America under the stewardship act of the NPS to “*retain for posterity a proper memorial emblematical of the hardships and the pioneer life through which the early settlers passed in the settlement, cultivation and civilization of the Great West.*” (United States Department of the Interior, National Park Service, Midwest Regional Office. 1999).

In 1998 Congress passed the National Parks Omnibus Management Act in response to concerns about the condition of natural resources within the national parks. The act requires each park to gather baseline inventory data on pertinent natural resources, data that will provide a pivotal step toward establishing an effective monitoring program furthering the ability to effectively manage and protect park resources. The National Park Service (NPS) responded with the Natural Resource Challenge program, including the establishment of biome-based inventory and monitoring networks. The Heartland Network, as part of the NPS Inventory and Monitoring (I&M) program, has undertaken inventories of vascular plants and vertebrates within fifteen parks in eight Midwestern states.

Prior to this census, the population status of the white-tailed deer was previously unknown at the park. Numerous reports have been documented regarding white-tailed deer populations and vehicle/deer incidents, chronic wasting disease, and vegetation overbrowsing. Adequate baseline information regarding population status will enable managers to conduct appropriate methods of control to ensure that deer numbers will have a minimal impact on park resources and the number of deer-vehicle collisions. The surveys will also increase the data base when dealing with management issues in the future.

Local citizens had expressed concern that the park had an overabundance of deer-an overabundance that was blamed for numerous vehicle/deer collisions. In 2001, four incidents were reported, in 2002 four incidents were noted and in 2003 no vehicle/deer collisions were noted on the mile long stretch of highway bordering the park (Law Enforcement Case Incident Reports, Park File). With highways bordering the park on three sides, the concern over deer-vehicle collisions is ever present.

Chronic wasting disease in the near future may also be a major concern as it has already been document in western Nebraska. If the deer at the park would happen to become infected with chronic wasting disease, data about historic populations would be invaluable.

Additionally, research elsewhere has shown that high deer populations contribute to over-browsing of vegetation, which can lead to plant mortality, decreased plant reproduction, and may tend to favor less preferred species. This shift in species assemblages can reduce plant diversity on a local level and cause changes in the functioning of the prairie community.

Stemming from the Natural Resource Challenge and a concern regarding the status of deer populations at the park, a census was deemed necessary to determine population status. During 2003 and 2004, a deer census was conducted at the park to ) estimate number of white-tailed deer by season, 2) estimate age class (adult or fawn) and sex structure, and 3) gather data pertaining to habitat (weather, vegetation type, etc.)

## Study Area

Homestead NM of America is located in southeastern Nebraska (Gage County) just west of the City of Beatrice (Figure 1). The property consists of 78.9 ha (195 ac) including; 40.5 ha (100 ac) of restored tallgrass prairie, 24.3 ha (60 ac) of hardwood forest, and 1.2 ha (3 ac) of administrative areas (roads, structures, and trails). The park is dissected by Cub Creek throughout the west end of the property.

The park commemorates the Homestead Act of 1862 and its effects upon the settlement of the West as well as advancements in agricultural technology. Homestead's purpose is to interpret the history of the country resulting in and from the Homestead Act. Included is the function of preserving literature, agricultural implements, and a museum to interpret settlement, cultivation, and development of the West. Homestead's purpose is to commemorate the peoples whose lives were altered by the Homestead Act.

The Monument is a "T" shape with a small parcel containing the original 160 acres homestead of Daniel Freeman and the Freeman School site. An estimated 35,000-40,000 people visit Homestead annually. Visitation is primarily during the summer months with dramatic increases during special programs; 27% of the visitors are from the local community; 4% have international origins; 66% of visitors identify the Monument as a day trip destination.

The park lies within the glaciated Drift Hill Region of Southeast Nebraska. Underlying formations, bedded limestone and shale, indicate that this area was once at the bottom of the ocean. The gently rolling topography of the Monument has an extreme relief of 21.3 m (70 ft). The average elevation of this area is approximately 384.1 m (1,260 ft) above sea level with the highest point on the Monument rising to 402.3 m (1,320 ft).

Today, the vegetation of the Monument is roughly two-thirds reconstructed prairie and one-third woodland, the same general ratio of native prairie/woodland found by the original surveyors of the area. The Freeman School grounds (approximately 2.5 acres total size) contain a 0.75-acre remnant of untilled native prairie. The south and southeast upland slopes within the Monument contain the best examples of tallgrass prairie.

Dominant grasses include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indiangrass (*Sorghastum nutans*). Common forbs include goldenrods (*Solidago spp.*), sunflowers (*Helianthus spp.*), and leadplant (*Amarpha canescens*). The woodland and riparian vegetation consists primarily of bur oak (*Quercus macrocarpa*), ash (*Fraxinus pennsylvanicus*), silver maple (*Acer saccharinum*), hackberry (*Celtis occidentalis*), boxelder (*Acer negundo*), red elm (*Ulmus rurbum*), and cottonwood (*Populus deltoides*).

Environmental concerns at the Monument stem mainly from agricultural land use which surrounds Homestead. Corn, wheat, and grain sorghum are the major crops. Nearby industrial development including two anhydrous ammonia fertilizer plants which operate north of the Freeman school along with state highway 4 which dissects the Monument are some of the other concerns. On the northeast, a 27-home residential subdivision borders the Monument.

## Materials and Methods

Deer were counted three times per season (with the exception of November when only 2 counts were conducted) for a total 11 counts (late May, early September, mid to late November 2003, and late February 2004). Deer census methods (counts) followed Wilson et al. (1996). At Homestead, deer were driven to the western border of the park where stationary observers were located (Figure 2) to count the deer as they left the Monument. The drivers are responsible for counting all the deer that go back toward the east.

Approximately 17 drivers were spaced at 50 meter intervals along the eastern border (Figure 2). Spacing varied depending on visibility (i.e. the amount of undergrowth that could conceal deer). Eight observers were spaced around the boundary. Drivers “pushed” the deer from the east to the west counting all deer that passed between them and the driver to their right.

Observers were hidden on the boundary (figure 2) to count and categorize (sex and age) deer as they entered or exited the park. Deer that backtracked through the line of drivers were counted (each driver recorded deer passing to their right). The original habitat that deer were driven from was also noted. Observer and driver positions are marked with flagging which is placed in predetermined positions which are located with a handheld GPS.

Total counts were calculated using the following formula:

$$\text{Total count} = (\text{number of deer moving ahead plus number of deer escaping between drivers}) \text{ minus number of deer entering the census area.}$$

While the census was in progress, traffic on State Highway 4 was regulated via signage placed just outside of the park’s boundaries on State Highway 4 and County Road Southwest 89. Additional traffic flow was monitored and regulated by park staff (with emergency vehicles).

After each count was completed, participants gathered for a debriefing to discuss the deer seen and determine any errors in census omission/commission.

## Results

Number of deer (buck, doe, or fawn) varied each day of each census period (Tables 1-5). The average number of deer seen for the 11 counts is 19.6. The density equals 76 deer per square mile, or 1 deer per 8 acres. The sex ratio could only be figured for November because of the growth stage of antlers resulting with a ratio of 1 buck for every 8 doe. The doe to fawn ratio was 5.9 doe to 1 fawn for May, September and November. This ratio is much higher than would be expected for this area, and is likely due to the fall counts not accurately differentiating between adult does, yearlings does, and large fawns. February was excluded because the sex of all deer observed was unknown. Total numbers of deer increased as the reproductive and winter season progressed (Figure 3).

The number of deer per square mile ranged from 36 in late summer to 140 in late fall. The density of deer correlated with the amount of forage the surrounding area. The late summer count was when the monument was surrounded by mature crops while during late fall and winter counts the monument was surrounded by bare fields.

## Discussion

During each census, the number of deer observed was influenced by: the deer's use of the habitat at the park, the degree of observer accuracy, and the number of volunteers.

In the May census all deer were seen in the woodland and were most difficult to count due to the foliage cover. Yet, by the September census, the deer were distributed evenly between the prairie and woodland. In November the deer were distributed in both the prairie and woods, while in February most were observed in the woodland.

November was the only period where bucks were counted (in May and February the bucks lacked antlers). Here, bucks accounted for 9.6% of the adult population yet this number may be low due to the difficult nature of identifying spike bucks and differentiating between does and fawns.

The doe to fawn ratio of 5.9 to 1 was not expected (the expected ratio was closer to 1 to 1) and was possibly a result due to the difficulty in differentiating between doe and fawns in all the months except May. During May any fawns that would have been around would have been newborns probably less than a month old or unborn. They protect themselves by not moving (Stokes and Stokes 1986) therefore they were not seen. As such, September probably best represents the doe to fawn ratio of 1.8 doe to 1 fawn.

In November only two counts were completed due to the holiday and conflicting schedules. The first count was the Wednesday before rifle deer season and the second count was the Monday after rifle deer season. It appears that the deer use the Monument as a refuge from the hunters. The increase number of could also be related to the decrease in habitat due to harvesting of nearby cropland.

In February the census was postponed for a week due to snow cover which caused unsafe walking conditions. The Monument was under a blanket of 12-18" of snow from January 25 till February 20, 2004.

## Conclusion

Based on this census, the baseline data on deer population status and age/sex structure will better enable land managers to conduct appropriate methods of control to ensure that deer numbers will have a minimal impact on park resources and the number of deer-vehicle collisions. The deer censuses will also allow the Monument to document numbers so future trends can be identified and if needed corrective management actions taken.

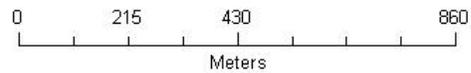
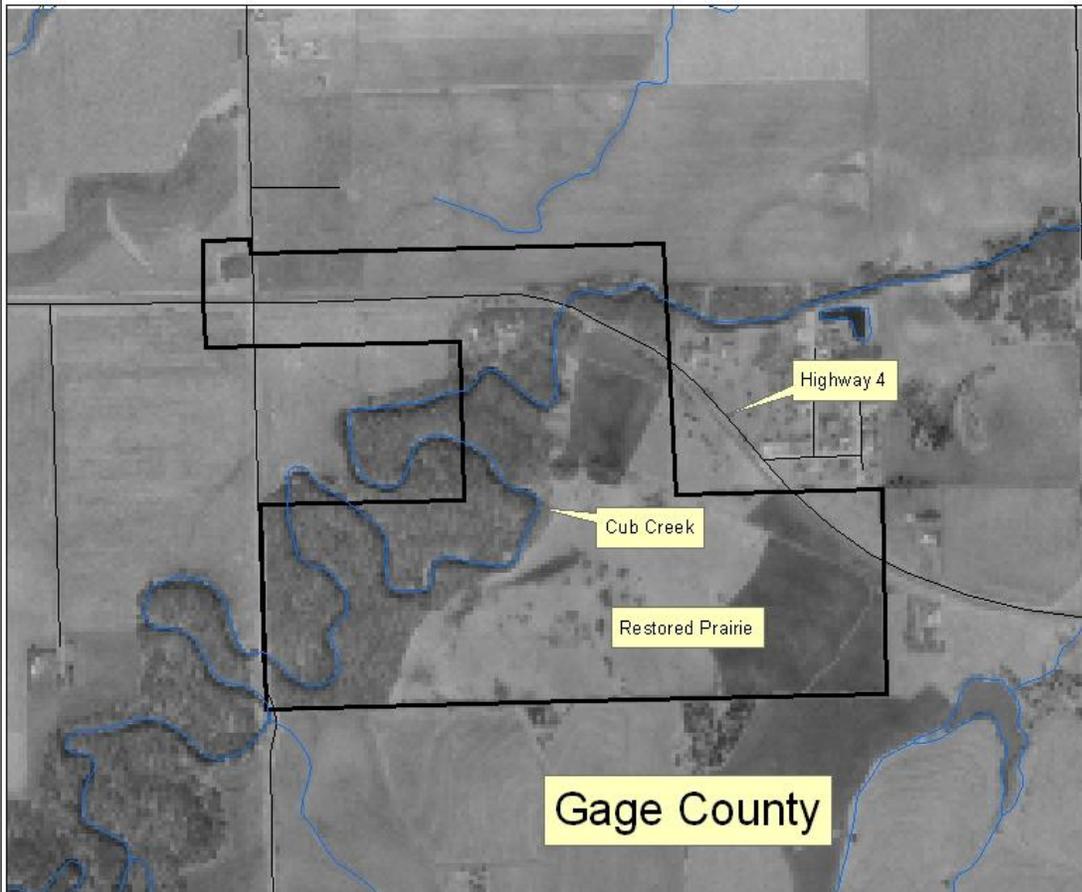
The following management is recommended:

- 1) The deer density of 76 per square mile is more than likely higher than would have been encountered before Euro American settlement. However due to the monuments small size and the range of the white-tailed deer no control is recommended.
- 2) To determine if the deer are having a negative impact on the monuments vegetation more studies are needed.
- 3) To reduce vehicle/deer collisions it is recommended that the ditches remain mowed at a minimum of 12 feet from the road edge which will limit vegetation near the road.
- 4) Conduct future deer counts to better determine the number of deer that use the park on a regular basis.
- 5) In the spring and summer months more volunteers are needed because of the increased vegetation.

## Literature Cited

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# Homestead NM of America



1:10,438



Map Produced by: Heartland Network  
Inventory and Monitoring Program

Data Source: National Park Service

Figure 1. Location of Homestead NM of America, Gage County, Nebraska.

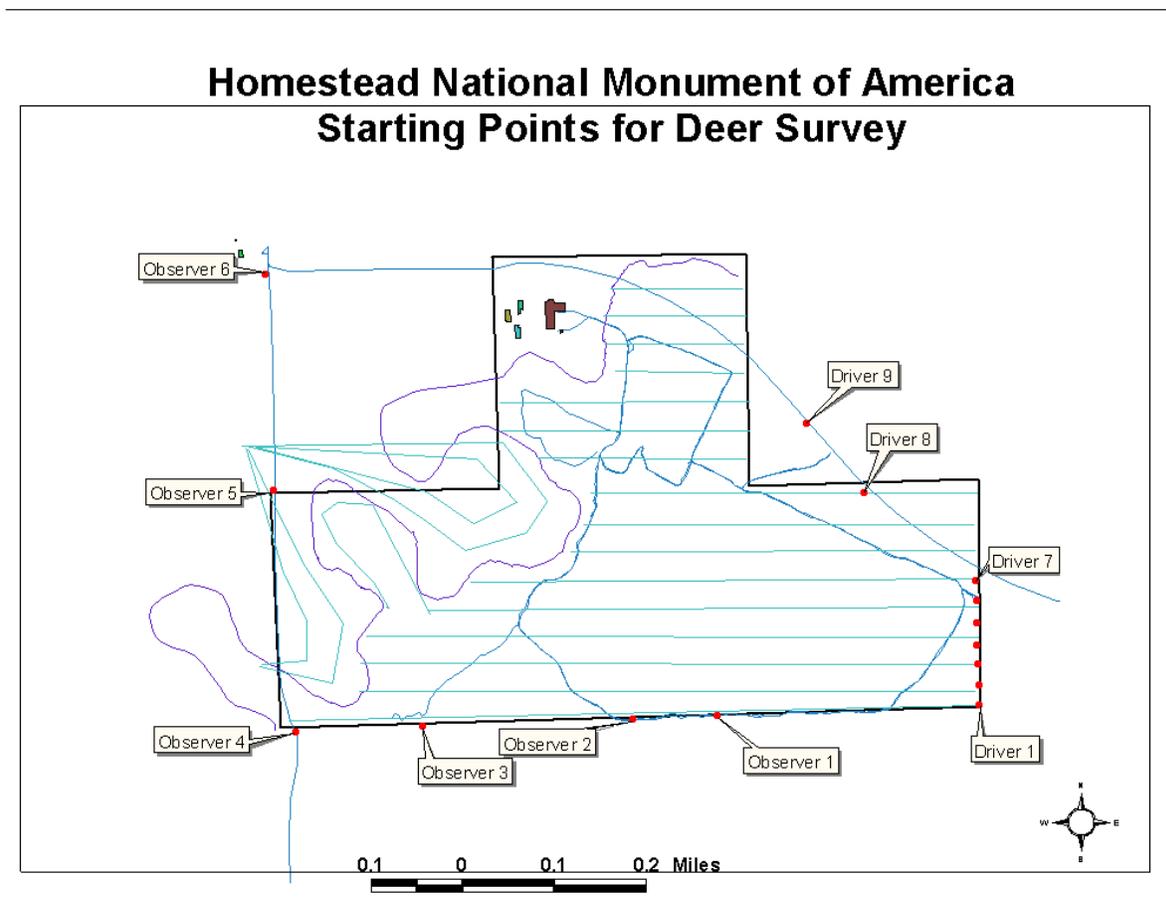


Figure 2. Stationary deer observation and driver points at Homestead NM of America.

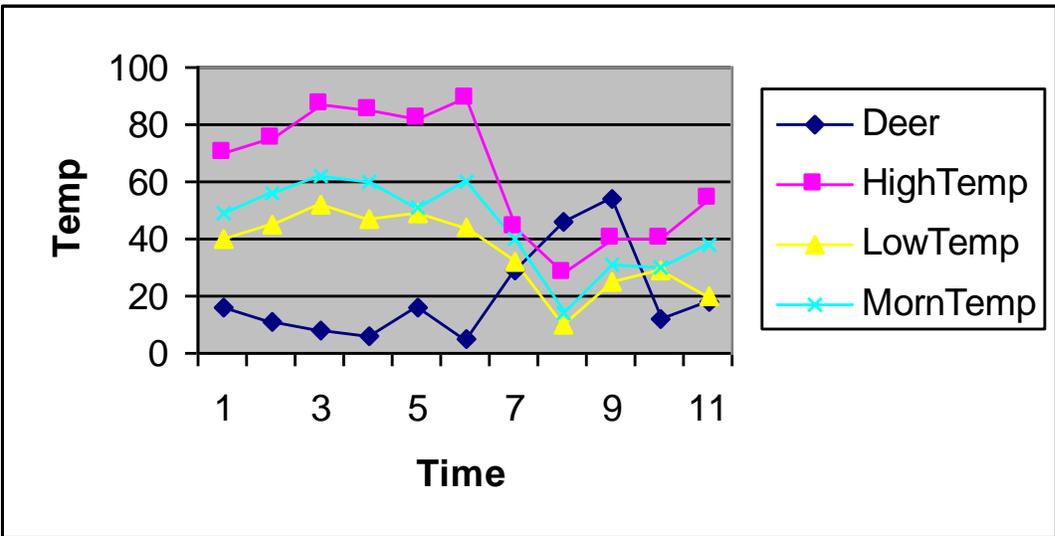


Figure 3. Reaction of deer over time based on temperature at Homestead NM of America.



Figure 4. Select pictures representing deer census methods at Homestead NM of America.

**Top left:** Drivers lining finding their place marked by the flagging.

**Top Right:** Observers on west boundary waiting for the deer.

**Bottom Left:** Drivers pushing the deer out of the Monument.

**Bottom Left:** A lucky observer at the creek catches a glimpse of a doe.

Table 1. Number and descriptive statistics of deer observed during the first census.

	Date		
	5/21/2003	5/22/2003	5/29/2003

# of Volunteers	20	16	18
<b>Deer</b>			
Buck	0	0	2
Doe	11	9	5
Fawn	3	2	1
Unknown	2	0	0
Total	16	11	8
	Census Statistics		
	Average #	11.7	
	SD	4.0	
	Range	8-16	
<b>Weather</b>			
High	70	75	87
Low	40	45	52
0830 Temp	49	56	62
Comments	Clear	Clear	Hazy

Table 2. Number and descriptive statistics of deer observed during the second census.

	Date		
	9/3/2003	9/4/2003	9/5/2003
# of Volunteers	18	18	17
<b>Deer</b>			
Buck	0	0	0
Doe	5	8	4
Fawn	0	8	1
Unknown	1	0	0
Total	6	16	5
	Census Statistics		
	Average #	9	
	SD	6.1	
	Range	5-16	
<b>Weather</b>			
High	85	82	89
Low	47	49	44
0830 Temp	60	51	60
Comments	Clear	Clear	Clear

Table 3. Number and descriptive statistics of deer observed during the third census.

	Date	
	11/12/2003	11/24/2003
# of Volunteers	17	10
<b>Deer</b>		
Buck	5	2
Doe	23	43
Fawn	1	1
Unknown	0	0
Total	29	46
<b>Weather</b>		
High	44	28
Low	32	10
0830 Temp	40	14
Comments	Clear Windy 20+	Frigid/Calm
	Census Statistics	
	Average #	35
	SD	-
	Range	29-41

Table 4. Number and descriptive statistics of deer observed during the fourth census.

	Date		
	2/23/2004	2/25/2004	2/27/2004
# of Volunteers	19	16	14
<b>Deer</b>			
Buck			0
Doe			
Fawn			
Unknown	54	12	18
Total	54	12	18
<b>Weather</b>			
High	40	40	54
Low	25	29	20
0830 Temp	31	30	38
Comments	-	Gray/Calm	Clear windy
	Census Statistics		
	Average #	28	
	SD	22.7	
	Range	12-54	

Table 5. Overall numbers and descriptive statistics of deer observed during the censuses.

<b>Date</b>	<b>Total Deer</b>	
5/21/2003	16	
5/22/2003	11	
5/29/2003	8	
9/3/2003	6	
9/4/2003	16	
9/5/2003	5	
11/12/2003	29	
11/24/2003	41	
2/23/2004	54	
2/25/2004	12	
2/27/2004	18	
	<b>Average</b>	19.6
<b>Average - max and min</b>		17.4
<b>Standard Deviation</b>		15.56
	<b>Range</b>	5-54
	<b>Mode</b>	16
<b>Average Density of Deer/Acre</b>		0.11875
<b>Deer per acre</b>		<b>1 Deer per 8 acres</b>
<b>Average Density of Deer / Mile<sup>2</sup></b>		<b>76</b>

Appendix 1. Sample data sheet

**Homestead National Monument of America Deer Survey**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Task: Driver or Observer (Circle one)

Location: \_\_\_\_\_

Count Deer to your right (north)

Buck Exiting (B+) \_\_\_\_\_ Buck Entering (B-) \_\_\_\_\_  
Doe Exiting (D+) \_\_\_\_\_ Doe Entering (D-) \_\_\_\_\_  
Fawn Exiting (F+) \_\_\_\_\_ Fawn Entering (F-) \_\_\_\_\_  
Unknown Exiting (U+) \_\_\_\_\_ Unknown Entering (U-) \_\_\_\_\_

